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Solvophobic effects and relationships between the Gibbs energy and enthalpy for the solvation process

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Abstract

An approach is suggested to describe the solvophobic effects in various solvents, qualitatively and quantitatively. We analyzed the relationships between the Gibbs energies and enthalpies of solvation of alkanes in various solvents on the basis of existing experimental data. It is shown that for a large group of solvents, there is a linear correlation between the two quantities. Other solvents, primarily self-associated, show deviations from this line. These deviations are always positive, leading to a decrease in solubility, and can be used as a measure of the strength of the solvophobic effects. It is also shown that the solvophobic effects is not the only factor determining the solubility, even for alkane solutes. The magnitudes of contributions of the solvophobic effect into the Gibbs energies of solvation of various compounds in monohydric alcohols are determined. These magnitudes are found to be linearly correlated with a characteristic molecular volume of a solute. The slope of correlation grows up with the concentration of hydrogen bonds in the liquid solvent.

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Keywords

enthalpy, Gibbs energy, isoequilibrium relationship, solvation, solvophobic effects